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10/726,638	12/04/2003	Ja-Hum Ku	2421-000030/US	6177

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EXAMINER

BOOTH, RICHARD A

ART UNIT PAPER NUMBER

2812

DATE MAILED: 05/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

HA

# Office Action Summary

Application No.

10/726,638

Applicant(s)

KU ET AL.

Examiner

Richard A. Booth

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 15 February 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-37 is/are pending in the application.
- 4a) Of the above claim(s) 35-37 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-34 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 5, and 10 are rejected under 35 U.S.C. 102(e) as being anticipated by Amos et al., U.S. Patent 6,846,734.

Amos et al. shows the invention as claimed including a method of forming a nickel silicide layer on an exposed silicon surface comprising: depositing a nickel alloy 58 on the exposed silicon surface 56, the nickel alloy including nickel and an alloying metal; reacting the nickel alloy layer with the exposed silicon surface to form a nickel silicide layer having an upper layer and a lower layer (see fig. 13 and col. 9-line 10 to col. 10-line 34).

With respect to the reaction of the nickel alloy with the exposed silicon surface causing the alloying metal to be preferentially segregated in the upper layer, it would be inherent that such a process would occur in the Amos et al. reference based upon the processes conducted.

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Concerning claims 5 and 10, note that a capping layer of titanium nitride 60 is formed on the nickel alloy before reacting the nickel alloy with the exposed silicon, where the nitrogen:titanium atomic ratio is at least 0.5.

Claims 1, 15, 21, 25, and 31-32 are rejected under 35 U.S.C. 102(e) as being anticipated by Paton et al., U.S. Patent 6,797,614.

Paton et al. shows the invention as claimed including a method of forming a metal layer on an exposed silicon surface comprising: depositing a nickel alloy 47 on the exposed silicon surface, the nickel alloy including nickel and an alloying metal; reacting the nickel alloy layer with the exposed silicon surface to form a nickel silicide layer (64,66,68) having an upper layer and a lower layer (see fig. 6 and col. 5-line 9 to col. 6-line 2).

With respect to the reaction of the nickel alloy with the exposed silicon surface causing the alloying metal to be preferentially segregated in the upper layer, it would be inherent that such a process would occur in the Paton et al. reference based upon the processes conducted.

Regarding claims 15, 21, 25, and 31-32, note that the nickel alloy is formed on an active region and exposed silicon substrate and is nickel monosilicide.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 2-4, 6-9, and 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Amos et al., U.S. Patent 6,846,734.

Amos et al. is applied as above but does not expressly disclose the claimed concentrations of alloying elements and relative thicknesses of the upper and lower layers. However, the claimed concentrations of the alloying elements overlap with the range disclosed in Amos et al. and therefore a prima facie case of obviousness exists (see MPEP 2144.05). With respect to the relative thicknesses of the upper and lower layers, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine through routine experimentation the optimum relative thicknesses based upon a variety of factors including the desired sheet resistance of the silicide layer and such limitation would not lend patentability to the instant application absent a showing of unexpected results.

Claims 2-4, 7-9, 16-18, 26, 28-30, and 33-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paton et al., U.S. Patent 6,797,614.

Paton et al. is applied as above but does not expressly disclose the claimed concentrations of alloying elements, the claimed temperature of reaction, and relative thicknesses of the upper and lower layers. However, the claimed concentrations of the alloying elements and the reaction temperatures overlap with the range disclosed in Amos et al. and therefore a prima facie case of obviousness exists (see MPEP 2144.05). With respect to the relative thicknesses of the upper and lower layers, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine through routine experimentation the optimum relative thicknesses based upon a variety of factors including the desired sheet resistance of the silicide layer and such limitation would not lend patentability to the instant application absent a showing of unexpected results.

Claims 5-6, 10-14, 19-20, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paton et al., U.S. Patent 6,797,614 in view of Amos et al., U.S. Patent 6,846,734.

Paton et al. is applied as above but does not expressly disclose a capping layer of titanium nitride formed over the nickel alloy prior to reaction and then removed after the reaction.

Amos et al. discloses forming a capping layer of titanium nitride 60 on the nickel alloy before reacting the nickel alloy with the exposed silicon, where the nitrogen:titanium atomic ratio is at least 0.5 (see fig. 13 and col. 9-line 10 to col. 10-line 34). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Paton et al. so as to form a titanium nitride capping layer as disclosed by Amos et al. because the capping layer prevents unwanted impurities from entering the nickel alloy layer during reaction.

Claims 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paton et al., U.S. Patent 6,797,614 in view of Chittipeddi et al., U.S. Patent 6,498,080.

Paton et al. is applied as above but does not expressly disclose forming a gate capping layer on the gate electrode to protect an upper surface of a polysilicon layer included in the gate electrode and exposing silicon surfaces only on the gate electrode while covering the source/drain regions with an insulating layer.

Chittipeddi et al. discloses exposing silicon surfaces on the gate electrode 15 while covering the source/drain regions with an insulating layer 57 (see fig. 12) or forming a gate capping layer 17 on the gate electrode to protect an upper surface of a polysilicon layer included in the gate electrode (see figs. 8-9). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Paton et al. so as to include the silicidation processes of Chittipeddi et al. because this allows for greater flexibility in the process

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since the gate and source/drain regions do not need to be all silicided or all silicided from the same material.

### ***Response to Arguments***

Applicant's arguments filed 2/15/06 have been fully considered but they are not persuasive. Applicant argues that the rejection under 35 USC 102(e) using the Amos reference is improper. However, the examiner respectfully submits that the rejection is proper because the Amos reference suggests multiple embodiments one or more of which will inherently produce the claimed process and therefore a substantial number of the claims are properly rejected under 35 USC 102.

Concerning the Payton et al. reference, for the purposes of argument applicant relies upon an alternative embodiment which is not cited or relied upon by the examiner.

Regarding the rejections under 35 USC 103, the examiner again respectfully submits that as described above parameters such as the relative thicknesses of layers and concentrations would be optimized during routine experimentation and are prima facie obvious absent a showing of unexpected results. Furthermore, the fact that the references fail to disclose an upper and lower layer as claimed, even if true, does not take away from the fact that the layers would be expected to be inherently formed in the references based upon similar alloying elements and processing conditions.



***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard A. Booth whose telephone number is (571) 272-1668. The examiner can normally be reached on Monday-Thursday from 7:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Richard A. Booth  
Primary Examiner  
Art Unit 2812

April 19, 2006